Summary

A. Solution calculations

In this section the calculations for the preparation of solutions used throughout the project are shown.

A.1. Potassium ferricyanide/ferrocyanide

A mother solution of ferricyanide/ferrocyanide 2 mM with a buffer solution in pH 7.4 of phosphate 100 mM is prepared in 0,5 L. The calculations are the following:

- Ferricyanide:

$$0{,}5\ L \cdot \frac{2\ mmol}{1\ L} \cdot \frac{1\ mol}{1000\ mmol} \cdot \frac{329{,}24\ g}{1\ mol} = \mathbf{0{,}3292\ g\ of\ K_3Fe(CN)_6}$$

- Ferrocyanide:

$$0{,}5\ L \cdot \frac{2\ mmol}{1\ L} \cdot \frac{1\ mol}{1000\ mmol} \cdot \frac{422{,}39\ g}{1\ mol} = \mathbf{0{,}4224\ g\ of\ K_4Fe(CN)_6 \cdot 3H_2O}$$

- Sodium phosphate:

$$0{,}5\ L \cdot \frac{0{,}1\ mol}{1\ L} \cdot \frac{177{,}99\ g}{1\ mol} = \mathbf{8{,}8995\ g\ of\ Na_2HPO_4 \cdot 2H_2O}$$

A.2. Reagents involved

- Antimony solution 50 ppm with HCl 0,01 M in 250 mL.

$$250\ mL \cdot \frac{0{,}01\ mol}{1\ L} \cdot \frac{1\ L}{1\ mol} = \mathbf{2{,}5\ mL\ of\ HCl\ 1\ M}$$

$$C_i \cdot V_i = C_f \cdot V_f \rightarrow V_i = \frac{50\frac{mg}{L} \cdot 250\ mL}{1000\frac{mg}{L}} = \mathbf{12{,}5\ mL\ of\ Sb(III)\ 1000\ ppm}$$

- Dimethylglyoxime ($C_4H_8N_2O_2$) 0,1 M in 100 mL and 95% of methanol.

$$100\ mL \cdot \frac{1\ L}{1000\ mL} \cdot \frac{0{,}1\ mol}{1\ L} \cdot 116{,}11\frac{g}{mol} = \mathbf{1{,}16\ g\ of\ C_4H_8N_2O_2}$$

- Ammonia buffer solution 0,1 M and pH 9,2 in 1 L.

$$1\ L \cdot 0{,}1 \frac{mol}{L} \cdot \frac{1\ L}{13{,}25\ mol} = 7{,}55 \cdot 10^{-3}\ L = \mathbf{7{,}55\ mL\ of\ ammonia\ solution}$$

A.3. Nickel solutions

Different nickel solutions with different concentrations are prepared from standard solution of Ni (II) 1000 ppm to carry on the determinations. These are used for both external addition or to add into Dosinos.

- Nickel solution 50 ppm (from 1000 ppm) in 50 mL.

$$C_i \cdot V_i = C_f \cdot V_f \rightarrow 1000\ \frac{mg}{L} \cdot V_i = 50\ \frac{mg}{L} \cdot 50\ mL$$

$$\boldsymbol{V_i = 2{,}5\ mL\ of\ Ni\ 1000\ ppm\ sample}$$

- Nickel 20 ppb in cell determination.

$$50 \frac{mg}{L} \cdot V_i = 0{,}02 \frac{mg}{L} \cdot (20{,}01 + V_i)\ mL \rightarrow \boldsymbol{V_i} = 8 \cdot 10^{-3}\ mL = \mathbf{8\ \mu L\ of\ Ni\ 50\ ppm\ sample}$$

A.3.1. External addition with one sample

First, the concentration of nickel solution that will be added to the cell is calculated.

- Nickel solution 0,8 ppm (from 1000 ppm) in 50 mL.

$$C_i \cdot V_i = C_f \cdot V_f \rightarrow 1000\ \frac{mg}{L} \cdot V_i = 0{,}8\ \frac{mg}{L} \cdot 50\ mL$$

$$\boldsymbol{V_i} = 0{,}04\ mL = \mathbf{40\ \mu L\ of\ Ni\ 1000\ ppm\ sample}$$

Then, the volume that will be pipetted into each addition is also calculated.

- Addition 1: Nickel 2 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot V_i = 0{,}002 \frac{mg}{L} \cdot (20{,}01 + V_i)\ mL \rightarrow \boldsymbol{V_i}\ = 0{,}05\ mL = \mathbf{50\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 2: Nickel 20 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 0{,}05)\ mL = 0{,}02 \frac{mg}{L} \cdot (20{,}06 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}463\ mL$$
$$= \boldsymbol{463\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 3: Nickel 40 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 0{,}513)\ mL = 0{,}04 \frac{mg}{L} \cdot (20{,}523 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}540\ mL$$
$$= \boldsymbol{540\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 4: Nickel 60 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 1{,}053)\ mL = 0{,}06 \frac{mg}{L} \cdot (21{,}063 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}569\ mL$$
$$= \boldsymbol{570\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 5: Nickel 80 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 1{,}622)\ mL = 0{,}08 \frac{mg}{L} \cdot (21{,}632 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}601\ mL$$
$$= \boldsymbol{601\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 6: Nickel 100 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 2{,}223)\ mL = 0{,}1 \frac{mg}{L} \cdot (22{,}233 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}635\ mL$$
$$= \boldsymbol{635\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 7: Nickel 120 ppb in cell.

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 2{,}859)\ mL = 0{,}12 \frac{mg}{L} \cdot (22{,}869 + V_i)\ mL \rightarrow\ \boldsymbol{V_i}\ = 0{,}672\ mL$$
$$= \boldsymbol{672\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 8: Nickel 140 ppb in cell

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 3{,}53)\ mL = 0{,}14 \frac{mg}{L} \cdot (23{,}54 + V_i)\ mL \rightarrow \boldsymbol{V_i} = 0{,}715\ mL$$
$$= \boldsymbol{715\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 9: Nickel 160 ppb in cell

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 4{,}24)\ mL = 0{,}16 \frac{mg}{L} \cdot (24{,}25 + V_i)\ mL \rightarrow \boldsymbol{V_i} = 0{,}763\ mL$$
$$= \boldsymbol{763\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

- Addition 10: Nickel 180 ppb in cell

$$0{,}8\ \frac{mg}{L} \cdot (V_i + 5)\ mL = 0{,}18 \frac{mg}{L} \cdot (25{,}01 + V_i)\ mL \rightarrow \boldsymbol{V_i} = 0{,}809\ mL$$
$$= \boldsymbol{809\ \mu L\ of\ Ni\ 0{,}8\ ppm}$$

A.3.2. External addition with multiple samples

All the solutions are prepared from nickel 50 ppm solution

- Nickel solution 0,25 ppm in 50 mL.

$$\boldsymbol{V_i} = \frac{0{,}25 \frac{mg}{L} \cdot 50\ mL}{50 \frac{mg}{L}} = \boldsymbol{0{,}25\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 0,5 ppm.

$$\boldsymbol{V_i = 0{,}5\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 1 ppm.

$$\boldsymbol{V_i = 1\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 2 ppm.

$$\boldsymbol{V_i = 2\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 3 ppm.

$$\boldsymbol{V_i = 3\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 4 ppm.

$$\boldsymbol{V_i = 4\ mL\ of\ Ni\ 50\ ppm}$$

- Nickel solution 5 ppm.

$$\boldsymbol{V_i = 5\ mL\ of\ Ni\ 50\ ppm}$$

The volume added from these samples is constant. So, 1 mL of these prepared solutions will be pipetted in cell each determination.

A.3.3. Internal addition with Dosinos

- Nickel solution 0,5ppm in Dosino:

$$50\ \frac{mg}{L} \cdot V_i = 0{,}5\ \frac{mg}{L} \cdot 100\ mL \rightarrow V_i = \boldsymbol{1\ mL\ of\ Ni\ 50\ ppm}$$

Then, 0,7 mL of this solution is pipetted automatically for the next two determinations to complete the standard addition method.

A.3.4. Nickel Wood

$$54604{,}04\ \frac{mg}{L} \cdot 1\ mL = C_f \cdot 100\ mL \rightarrow C_{f1NW} = \boldsymbol{546{,}04\ ppm\ of\ Ni}$$

$$546{,}04\ \frac{mg}{L} \cdot 1\ mL = C_f \cdot 100\ mL \rightarrow C_{f2NW} = \boldsymbol{5{,}46\ ppm\ of\ Ni}$$

Then, 50 µL of this C_{f2} were pipetted to cell.

A.3.5. Bany Nickel

$$6180{,}32\ \frac{mg}{L} \cdot 1\ mL = C_f \cdot 100\ mL \rightarrow C_{f1BN} = \boldsymbol{61{,}80\ ppm\ of\ Ni}$$

$$61{,}80\ \frac{mg}{L} \cdot 1\ mL = C_f \cdot 100\ mL \rightarrow C_{f2BN} = \boldsymbol{0{,}61\ ppm = 618\ ppb\ of\ Ni}$$

In this case, 340 µL of this C_{f2} were pippeted for determining.

B. Results

B.1. Computrace report of nickel determination

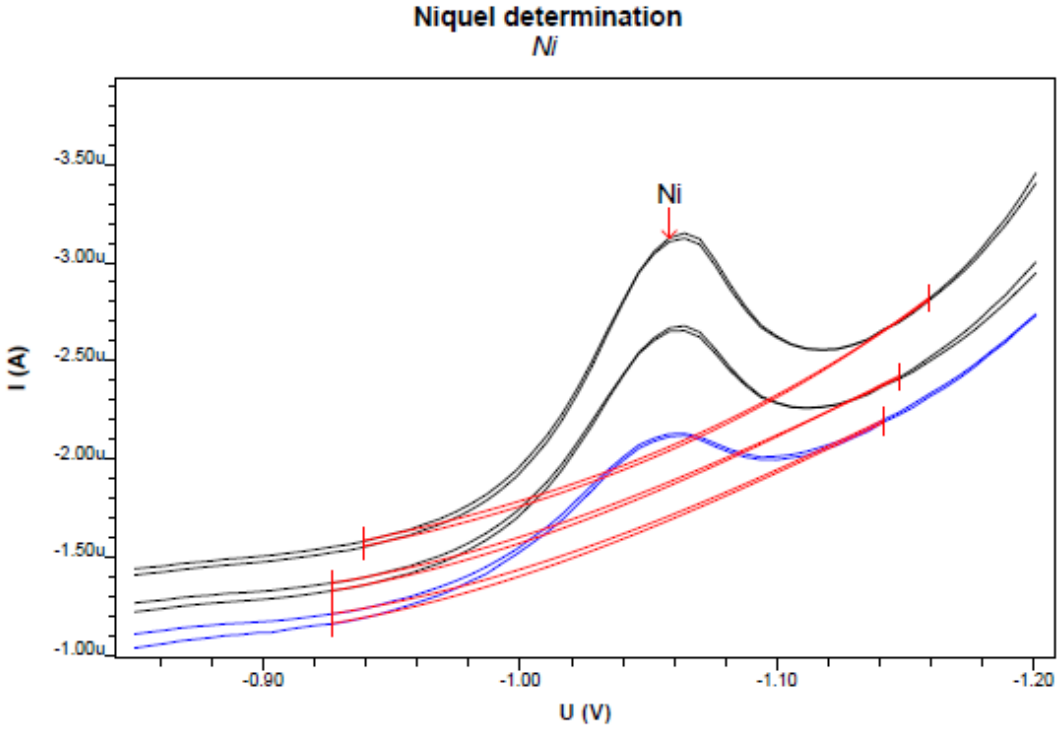
This example shows a default report of Bany nickel determination where different working conditions are observed. The graphics and the calculations are carried out automatically by the software.

METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

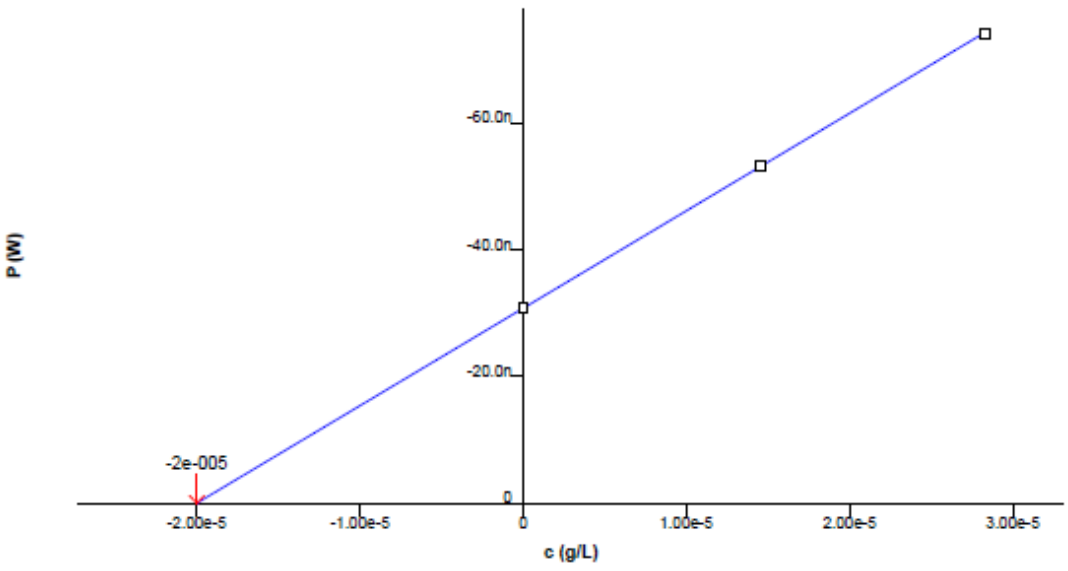
```
======= METROHM 797 VA COMPUTRACE (Version 1.3.0.77) (Serial No. 12157) ========
 Determination  : (16-06-10) Ni bany 10ppb (e57).dth
 Sample ID      : Ni
 Creator method :                  Date:       2016-04-29      Time:   15:55:23
 Creator determ.:                  Date:       2016-06-10      Time:   13:13:24
 Modified by    : ---              Date:                       Time:
--------------------------------------------------------------------------------
 Method         : Niquel determination wDosinos.mth
 Title          : Niquel determination
 Remark1        :
 Remark2        :
--------------------------------------------------------------------------------
 Sample amount  :  20.360 mL
 Cell volume    :  22.360 mL
--------------------------------------------------------------------------------

 Substance      : Ni
 Conc.          :  20.001 ug/L
 Conc.dev.      :   0.664 ug/L     ( 3.32%)
 Amount         : 447.229 ng
 Add.amount     : 350.000 ng

 VR     V       nW      P.mean  Std.Dev.  P.delta   Comments
 -----  ------  ------  ------  --------  --------  ----------------------
 1 - 1  -1.052  -31.03  -30.74     0.407      0.00
 1 - 2  -1.052  -30.46
 2 - 1  -1.058  -54.36  -53.37     1.405    -22.62
 2 - 2  -1.058  -52.37
 3 - 1  -1.058  -75.21  -74.11     1.552    -20.74
 3 - 2  -1.058  -73.01


 Substance    Calibr.      Y.reg/offset        Slope Mean deviat. Corr.Coeff.
 ------------ ------------ ------------ ------------ ------------ ------------
 Ni           std.add.      -3.077e-008  -1.539e-003   1.140e-009      0.99890

 Solutions
--------------------------------------------------------------------------------

  No. Content                                          Predose (mL)
  --- ------------------------------------------------ ------------
   2  Ni                                               -------


 Final results                       +/- Res. dev.    %     Comments
 ----------------------------------  ---------------  ----  --------------------

 Ni:
 default          =   21.966  ug/L    0.729        3.319


--------------------------------------------------------------------------------
 Electrode Test : passed
```

METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

```
Determination  : (16-06-10) Ni bany 10ppb (e57).dth
Sample ID      : Ni
Creator method :                  Date:       2016-04-29      Time:    15:55:23
Creator determ.:                  Date:       2016-06-10      Time:    13:13:24
Modified by    : ---              Date:                       Time:
```




```
Ni
c =   21.966 ug/L
+/-    0.729 ug/L (3.32%)
```



ETSEIB

METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

```
 Determination  : (16-06-10) Ni bany 10ppb (e57).dth
 Sample ID      : Ni
 Creator method :                  Date:       2016-04-29      Time:   15:55:23
 Creator determ.:                  Date:       2016-06-10      Time:   13:13:24
 Modified by    : ---              Date:                       Time:

--------------------------------------------------------------------------------
 Method parameters
--------------------------------------------------------------------------------
Method          : Niquel determination wDosinos.mth
Title           : Niquel determination
Remark1         :
Remark2         :

Calibration     : Standard addition
Technique       : Batch
Addition        : Automatic

Sample ID       : Ni
Sample amount (mL): 20.360
Cell volume (mL): 22.360

Voltammetric parameters
--------------------------------------------------------------------------------
Mode                                : DP - Differential Pulse

Highest current range               : 10  mA
Lowest current range                : 100 nA

Electrode                           : HMDE
Drop size (1..9)                    : 4
Stirrer speed (rpm)                 : 2000

Initial electr. conditioning        : No

No. of additions                    : 2
No. of replications                 : 2

Measure blank                       : No
Addition purge time (s)             : 60

Initial purge time (s)              :      300

Conditioning cycles
Start potential (V)                 :   -1.200
End potential (V)                   :   -0.100
No. of cycles                       :        0

Hydrodynamic (measurement)          :       No
Cleaning potential (V)              :   -1.250
Cleaning time (s)                   :   30.000
Deposition potential (V)            :   -0.700
Deposition time (s)                 :  120.000

Sweep
Equilibration time (s)              :   20.000
Start potential (V)                 :   -0.850
End potential (V)                   :   -1.200
Voltage step (V)                    :    0.006
Voltage step time (s)               :    0.400
Sweep rate (V/s)                    :    0.015
Pulse amplitude (V)                 :    0.050
Pulse time (s)                      :    0.040

Cell off after measurement          :      Yes
```

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METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

```
Peak evaluation
-------------------------------------------------------------------------------
Regression technique               : Linear Regression
Peak evaluation                    : Area
Minimum peak width (V.steps)       : 5
Minimum peak height (A)            : 1.000e-010
Reverse peaks                      : No
Smooth factor                      : 4
Eliminate spikes                   : Yes

Substances
-------------------------------------------------------------------------------
Ni                        : -1.050 V   +/- 0.050 V

Standard solution         : 2   500.000 ug/L
Addition volume (mL)      : 0.700

default                   : Final result (Ni) =
                            Conc * (22.36 / 20.36) * (1e+006 / 1) + 0 - 0

Baseline
-------------------------------------------------------------------------------
Substance Addition    automatic start (V) end (V) type        scope
-------------------------------------------------------------------------------
Ni        Sample      no        -0.927    -1.141  polynomial  wholePeak
          Addition 1  no        -0.927    -1.147  polynomial  wholePeak
          Addition 2  no        -0.939    -1.159  polynomial  wholePeak
-------------------------------------------------------------------------------

 Solutions
-------------------------------------------------------------------------------

  No. Content                                           Predose (mL)
  --- ------------------------------------------------- ------------
   2  Ni                                                -------


Export options
-------------------------------------------------------------------------------
Export final results as ASCII:  no

Export final results as CSV:    no

Export final results as XML:    no

Export determination to AutoDB: no
```

METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

```
 Method         : Niquel determination wDosinos.mth
 Creator method :               Date:   2016-04-29      Time:   15:55:23
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
 Method parameters
-------------------------------------------------------------------------------
Method          : Niquel determination wDosinos.mth
Title           : Niquel determination
Remark1         :
Remark2         :

Calibration     : Standard addition
Technique       : Batch
Addition        : Automatic

Sample ID       : Ni
Sample amount (mL): 20.360
Cell volume (mL): 22.360

Voltammetric parameters
-------------------------------------------------------------------------------
Mode                                : DP - Differential Pulse

Highest current range               : 10  mA
Lowest current range                : 100 nA

Electrode                           : HMDE
Drop size (1..9)                    : 4
Stirrer speed (rpm)                 : 2000

Initial electr. conditioning        : No

No. of additions                    : 2
No. of replications                 : 2

Measure blank                       : No
Addition purge time (s)             : 60

Initial purge time (s)              :      300

Conditioning cycles
Start potential (V)                 :   -1.200
End potential (V)                   :   -0.100
No. of cycles                       :        0

Hydrodynamic (measurement)          :       No
Cleaning potential (V)              :   -1.250
Cleaning time (s)                   :   30.000
Deposition potential (V)            :   -0.700
Deposition time (s)                 :  120.000

Sweep
Equilibration time (s)              :   20.000
Start potential (V)                 :   -0.850
End potential (V)                   :   -1.200
Voltage step (V)                    :    0.006
Voltage step time (s)               :    0.400
Sweep rate (V/s)                    :    0.015
Pulse amplitude (V)                 :    0.050
Pulse time (s)                      :    0.040

Cell off after measurement          :      Yes

Peak evaluation
```

METROHM 797 VA COMPUTRACE (Version 1.3) (Serial No. 12157)

```
--------------------------------------------------------------------------------
Regression technique                : Linear Regression
Peak evaluation                     : Height
Minimum peak width (V.steps)        : 5
Minimum peak height (A)             : 1.000e-010
Reverse peaks                       : No
Smooth factor                       : 4
Eliminate spikes                    : Yes

Substances
--------------------------------------------------------------------------------
Ni                        : -1.050 V   +/- 0.050 V

Standard solution         : 2   500.000 ug/L
Addition volume (mL)      : 0.700

default                   : Final result (Ni) =
                            Conc * (22.36 / 20.36) * (1e+006 / 1) + 0 - 0

Baseline
--------------------------------------------------------------------------------
Substance Addition    automatic start (V) end (V) type        scope
--------------------------------------------------------------------------------
Ni        Sample      yes       ---       ---     linear      wholePeak
          Addition 1  yes       ---       ---     linear      wholePeak
          Addition 2  yes       ---       ---     linear      wholePeak
--------------------------------------------------------------------------------

 Solutions
--------------------------------------------------------------------------------

  No. Content                                           Predose (mL)
  --- ------------------------------------------------- ------------
   2  Ni                                                --------


Export options
--------------------------------------------------------------------------------
Export final results as ASCII:  no

Export final results as CSV:    no

Export final results as XML:    no

Export determination to AutoDB: no
--------------------------------------------------------------------------------
```

B.2. Nickel Wood determinations

These determinations of Nickel Wood were obtained from the standard addition during the project.

- With the SPE Nº53.

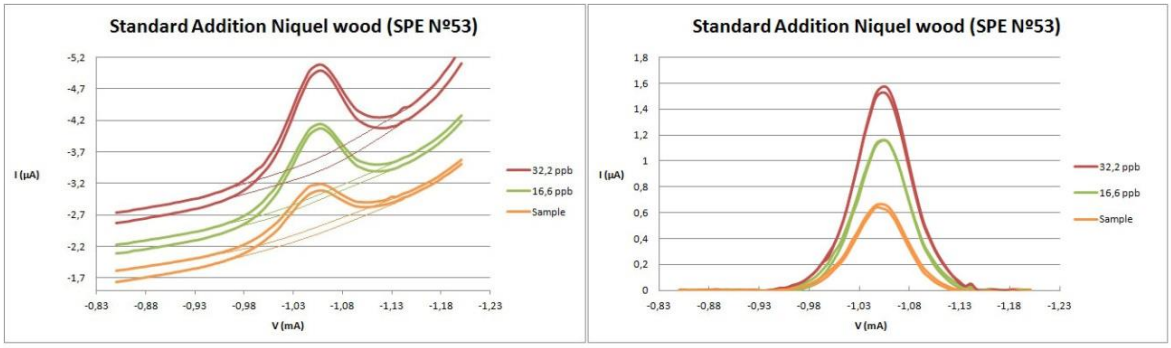

Fig. B.1. Determination of Nickel Wood by standard addition. (SPE Nº53)

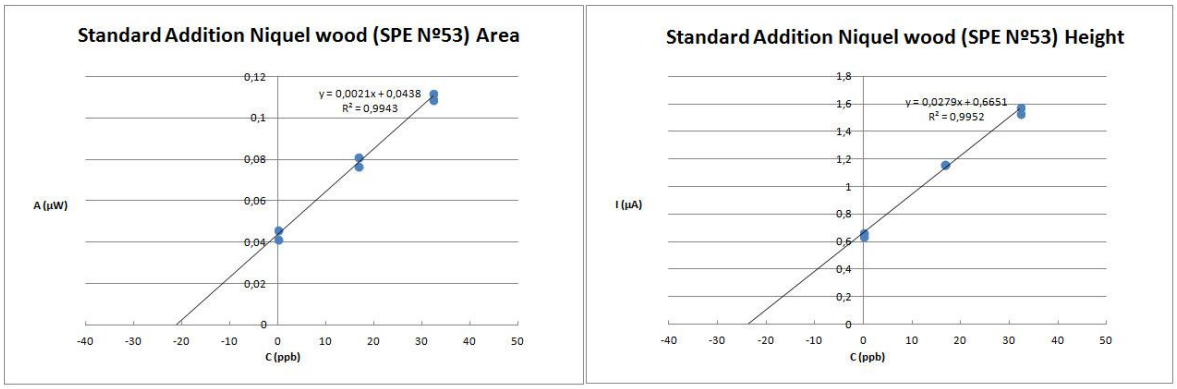

Fig. B.2. Standard addition of Nickel Wood (SPE Nº53). Points of OriginLab baseline.

$$Area: C_{NW} = 20{,}86\ ppb \qquad Peak\ Height: C_{NW} = 23{,}84\ ppb$$

- With the SPE Nº54.

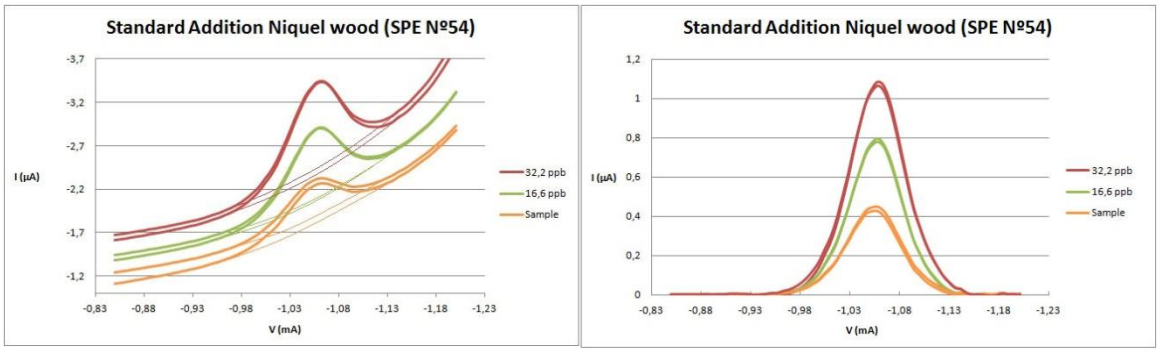

Fig. B.3. Determination of Nickel Wood by standard addition. (SPE Nº54).

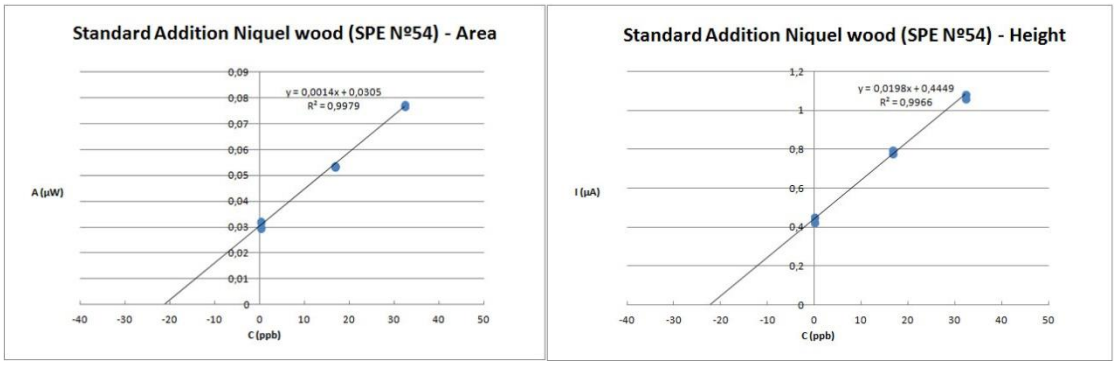

Fig. B.4. Standard addition of Nickel Wood (SPE Nº54). Points of OriginLab baseline.

$$Area: C_{NW} = 21{,}7\ ppb \qquad Peak\ Height: C_{NW} = 22{,}68\ ppb$$

- With the SPE Nº55.

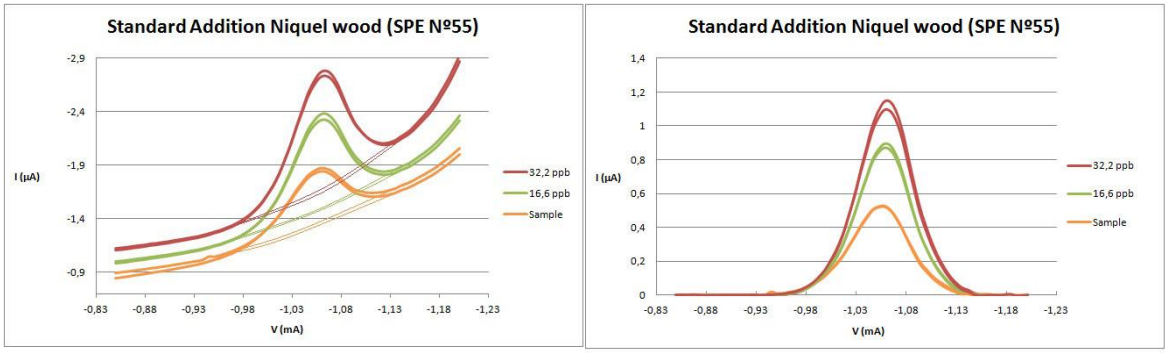

Fig. B.5. Determination of Nickel Wood by standard addition. (SPE Nº55).

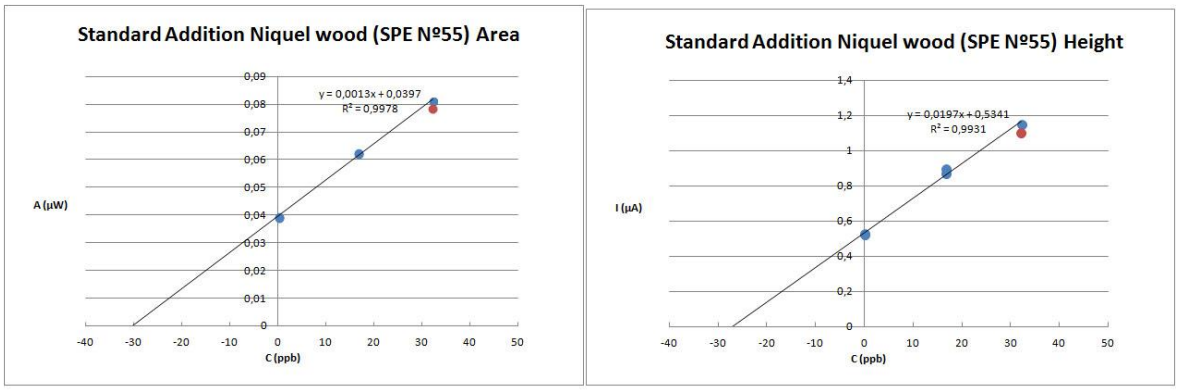

Fig. B.6. Standard addition of Niquel Wood (SPE Nº55). Points of OriginLab baseline.

$$Area: C_{NW} = 30{,}5\ ppb \qquad Peak\ Height: C_{NW} = 27{,}11\ ppb$$

B.3. Bany Niquel determinations

These determinations of Bany Nickel were obtained from the standard addition during the project.

- With the SPE Nº56

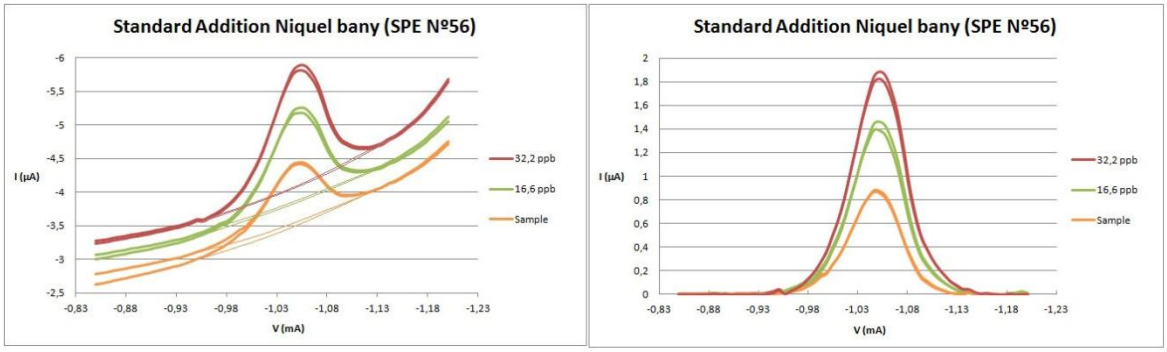

Fig. B.7. Determination of Bany Nickel by standard addition. (SPE Nº56).

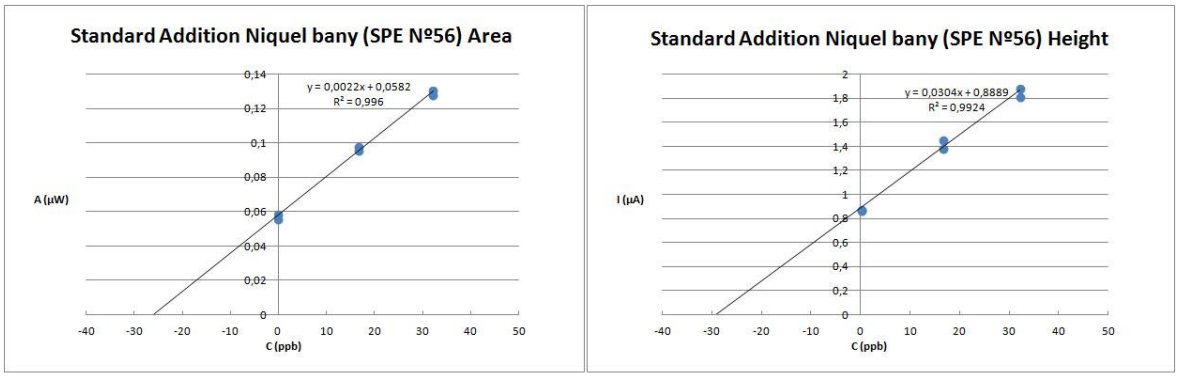

Fig. B.8. Standard addition of Bany Nickel (SPE Nº56). Points of OriginLab baseline.

$Area: C_{BN} = 26{,}45\ ppb$ $Peak\ Height: C_{BN} = 29{,}24\ ppb$

With the SPE Nº57

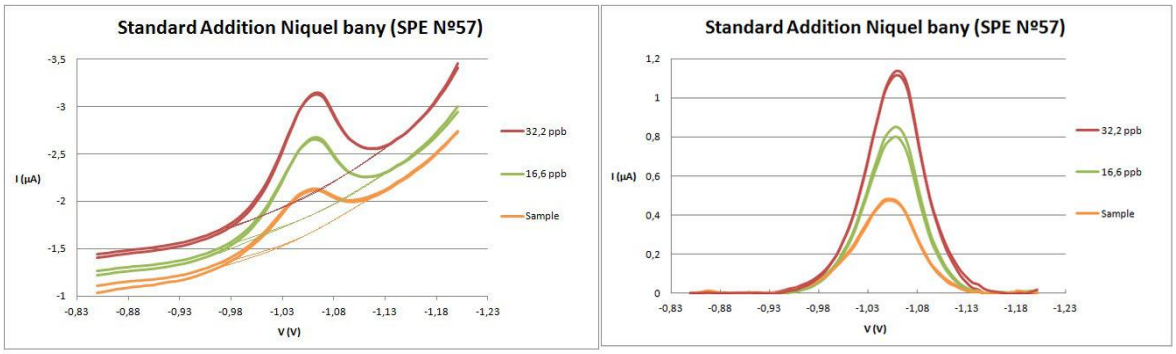

Fig. B.9. Determination of Bany Nickel by standard addition. (SPE Nº57).

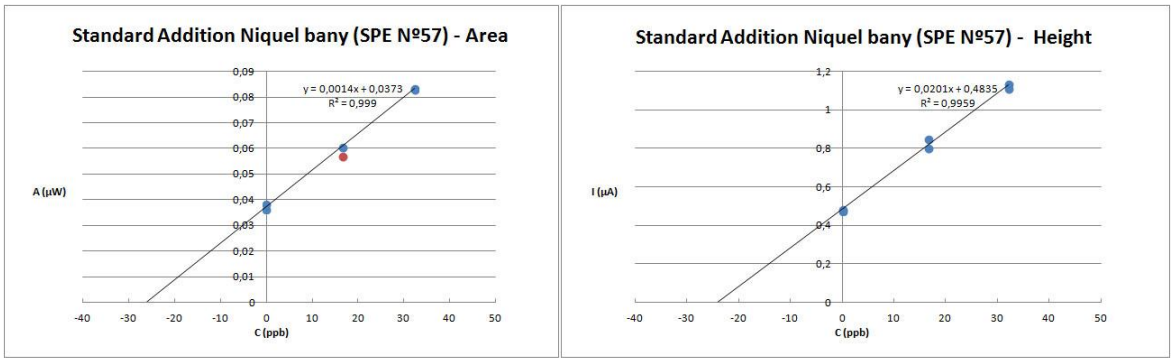

Fig. B.10. Standard addition of Bany Nickel (SPE Nº57). Points of OriginLab baseline.

$Area: C_{BN} = 26{,}6\ ppb$ $Peak\ Height: C_{BN} = 24{,}01\ ppb$

- With the SPE Nº 58.

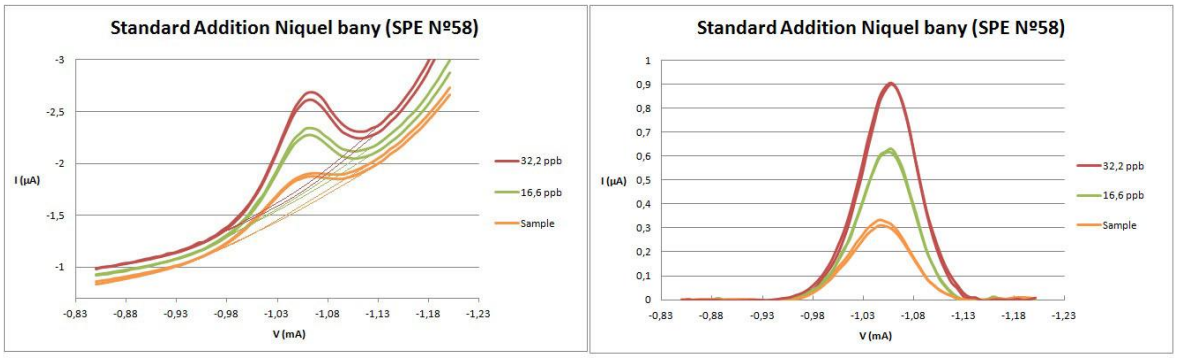

Fig. B.11. Determination of Bany Nickel by standard addition. (SPE Nº58)

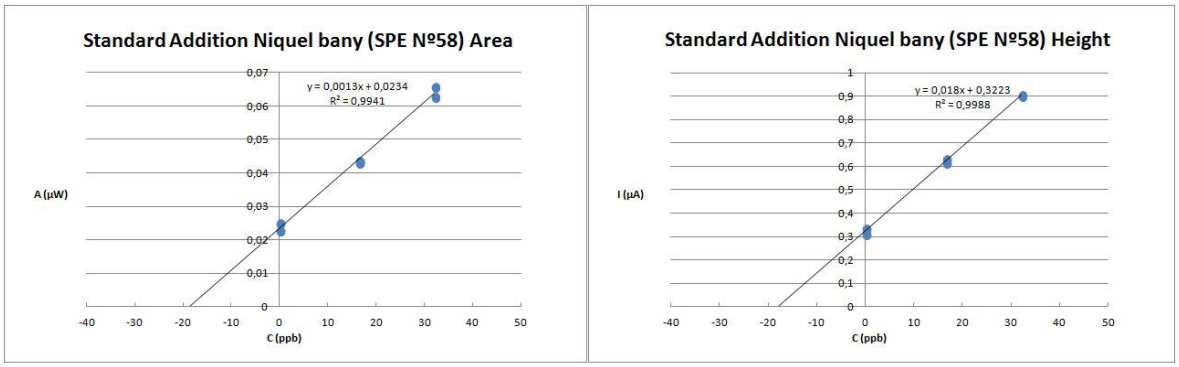

Fig. B.12. Standard addition of Bany Nickel (SPE Nº58). Points of OriginLab baseline.

$$Area: C_{BN} = 18\ ppb \qquad Peak\ Height: C_{BN} = 17{,}9\ ppb$$

C. Safety Data Sheets

C.1. Mercury

MERCURY
Safety Data Sheet
according to the federal final rule of hazard communication revised on 2012 (HazCom 2012)
Date of issue: 11/19/2013

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name : MERCURY
CAS No : 7439-97-6
Other means of identification : Colloidal Mercury, Quick Silver, Liquid Silver, NCI-C60399, Hydrargyrum

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Variety of industrial, analytical and research applications.

1.3. Details of the supplier of the safety data sheet

Bethlehem Apparatus Company

809 Front Street
Hellertown, Pa 18055

Phone: 610-838-7034

1.4. Emergency telephone number

Emergency number : 1-800-424-9300

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Acute Tox. 1 (Inhalation:dust,mist)	H330
Repr. 1B	H360
STOT RE 1	H372
Aquatic Acute 1	H400
Aquatic Chronic 1	H410

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :

GHS06 GHS08 GHS09 GHS05

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) :
H330 - Fatal if inhaled
H360 - May damage fertility or the unborn child
H372 - Causes damage to organs through prolonged or repeated exposure
H400 - Very toxic to aquatic life
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (GHS-US) :
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe vapors, gas
P264 - Wash skin, hands thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P273 - Avoid release to the environment
P280 - Wear eye protection, protective clothing, protective gloves, Face mask
P284 - [In case of inadequate ventilation] wear respiratory protection
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P310 - Immediately call a POISON CENTER/doctor/...
P314 - Get medical advice and attention if you feel unwell
P320 - Specific treatment is urgent (see First aid measures on this label)
P391 - Collect spillage
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to comply with applicable local, national and international regulation.

2.3. Other hazards

other hazards which do not result in classification : When inhaled, Mercury will be rapidly distributed throughout the body. During this time, Mercury will cross the blood-brain barrier, and become oxidized to the Hg (II) oxidation state. The oxidized species of Mercury cannot cross the blood-brain barrier and thus accumulates in the

11/23/2013 EN (English) Page 1

brain. Mercury in other organs is removed slowly from the body via the kidneys. The average half-time for clearance of Mercury for different parts of the human body is as follows: lung: 1.7 days; head: 21 days; kidney region: 64 days; chest: 43 days; whole body: 58 days. Mercury can be irritating to contaminated skin and eye. Prolonged contact may lead to ulceration of the skin. Allergic reactions (i.e. rashes, welts) may occur in sensitive individuals. Mercury can be irritating to contaminated skin and eyes. Short-term over-exposures to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute, and potentially fatal lung disorders. Depending on the concentration of inhalation over-exposure, heart problems, damage to the kidney, liver or nerves and effects on the brain may occur.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Mercury	(CAS No) 7439-97-6	100	Acute Tox. 2 (Inhalation), H330 Repr. 1B, H360 STOT RE 1, H372 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If exposed or concerned: Get medical advice/attention.

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. Assure fresh air breathing. Allow the victim to rest. Immediately call a POISON CENTER or doctor/physician. In case of irregular breathing or respiratory arrest provide artificial respiration.

First-aid measures after skin contact : Wash immediately with lots of water (15 minutes)/shower. Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse. Seek immediate medical advice.

First-aid measures after eye contact : Rinse immediately and thoroughly, pulling the eyelids well away from the eye (15 minutes minimum). Keep eye wide open while rinsing. Seek medical attention immediately.

First-aid measures after ingestion : Immediately call a POISON CENTER or doctor/physician. Rinse mouth. If conscious, give large amounts of water and induce vomiting. Give water or milk if the person is fully conscious. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Short-term over-exposures to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute, chemical pneumonia, and pulmonary edema (a potentially fatal accumulation of fluid in the lungs) . Depending on the concentration of over-exposure, cardiac abnormalities, damage to the kidney, liver or nerves and effects on the brain may occur. Long-term inhalation over-exposures can lead to the development of a wide variety of symptoms, including the following: excessive salivation, gingivitis, anorexia, chills, fever, cardiac abnormalities, anemia, digestive problems, abdominal pains, frequent urination, an inability to urinate, diarrhea, peripheral neuropathy (numbness, weakness, or burning sensations in the hands or feet), tremors (especially in the hands, fingers, eyelids, lips, cheeks, tongue, or legs), alteration of tendon reflexes, slurred speech, visual disturbances, and deafness. Allergic reactions (i.e. breathing difficulty) may also occur in sensitive individuals.

Symptoms/injuries after skin contact : Symptoms of skin exposure can include redness, dry skin, and pain. Prolonged contact may lead to ulceration of the skin. Allergic reactions (i.e. rashes, welts) may occur in sensitive individuals. Dermatitis (redness and inflammation of the skin) may occur after repeated skin exposures.

Symptoms/injuries after eye contact : Symptoms of eye exposure can include redness, pain, and watery eyes. A symptom of Mercury exposure is discoloration of the lens of the eyes.

Symptoms/injuries after ingestion : If Mercury is swallowed, symptoms of such over-exposure can include metallic taste in mouth, nausea, vomiting, central nervous system effects, and damage to the kidneys. Metallic mercury is not usually absorbed sufficiently from the gastrointestinal tract to induce an acute, toxic response. Damage to the tissues of the mouth, throat, esophagus, and other tissues of the digestive system may occur. Ingestion may be fatal, due to effects on gastrointestinal system and kidneys.

Chronic symptoms : Long-term over-exposure can lead to a wide range of adverse health effects. Anyone using Mercury must pay attention to personality changes, weight loss, skin or gum discolorations, stomach pains, and other signs of Mercury over-exposure. Gradually developing syndromes ("Erethism" and "Acrodynia") are indicative of potentially severe health problems. Mercury can cause the development of allergic reactions (i.e. dermatitis, rashes, breathing difficulty) upon prolonged or repeated exposures. Refer to Section 11 (Toxicology Information) for additional data.

4.3. Indication of any immediate medical attention and special treatment needed

Treatment for Mercury over-exposure must be given. The following treatment protocol for ingestion of Mercury is from Clinical Toxicology of Commercial Products (5th Edition, 1984).

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable. Mercury vapors and oxides generated during fires involving this product are toxic.

Reactivity : Stable. Reacts with (some) metals. Mercury can react with metals to form amalgams.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment. Do not allow run-off from fire fighting to enter drains or water courses.

Protective equipment for firefighters : Do not enter fire area without proper protective equipment, including respiratory protection.

Other information : Decontaminate all equipment thoroughly after the conclusion of fire-fighting activities.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Uncontrolled release should be responded to by trained personnel using pre-planned procedures. Evacuate area. Evacuate personnel to a safe area.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection. In the event of a release under 1 pound: the minimum level "C" Personal Protective Equipment is needed. Triple-gloves (rubber gloves and nitril gloves over latex gloves), chemical resistant suit and boots, hard-hat, and Air-Purifying Respirator with Cartridge appropriate for Mercury.
In the event of a release over 1 pound or when concentration of oxygen in atmosphere is less than 19.5% or unknown, the level "B" Personal Protective Equipments which includes Self-Contained Breathing Apparatus must be worn.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters. Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

For containment : For larger spills, dike area and pump into waste containers. Put into a labelled container and provide safe disposal.

Methods for cleaning up : There are a variety of methods which can be used to clean-up Mercury spills. Use a commercially available Mercury Spill Kit for small spills. A suction pump with aspirator can also be used during clean-up operations. For larger release, a Mercury vacuum can be used. Calcium polysulfide or excess sulfur can be also used for clean-up. Mercury can migrate into cracks and other difficult-to-clean areas; calcium polysulfide and sulfur can be sprinkled effectively into these areas. Decontaminate the area thoroughly. The area should be inspected visually and with colorimetric tubes for Mercury to ensure all traces have been removed prior to re-occupation by non-emergency personnel. Decontaminate all equipment used in response thoroughly. If such equipments cannot de adequately decontaminated, it must be discarded with other spill residue. Place all spill residues in an appropriate container, seal immediately, and label appropriately. Dispose of in accordance with federal, state, and local hazardous waste disposal requirements. (Refer to Section 13 of this SDS).

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Supervisors and responsible personnel must be aware of personality changes, weight loss, or other sign of Mercury over-exposure in employees using this product; These symptoms can develop gradually and are indicative of potentially severe health effects related to Mercury contamination.

Precautions for safe handling : As with all chemicals, avoid getting Mercury ON YOU or IN YOU. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. Report all Mercury releases promptly. Open container slowly on a stable surface. Drums, flasks and bottles of this product must be properly labeled. Empty containers may contain residual amounts of Mercury and should be handled with care.

Hygiene measures : Do not eat, drink or smoke when using this product. Always wash hands and face immediately after handling this product, and once again before leaving the workplace. Remove contaminated clothing immediately.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Follow practice indicated in Section 6. Make certain that application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment thoroughly before maintenance begins.

Storage conditions : Keep container tightly closed. Store drums, flasks and bottles in a cool, dry location, away from direct sunlight, source of intense heat, or where freezing is possible. Store away from incompatible materials. Material should be stored in secondary container or in a diked area, as appropriate.

Incompatible materials : Acetylene and acetylene derivatives, amines, ammonia, 3-bromopropyne, boron diiodophosphide, methyl azide, sodium carbide, heated sulfuric acid, methylsilane/oxygen mixtures, nitric acid/alcohol mixtures, tetracarbonylnickel/oxygen mixtures, alkyne/silver perchlorate mixtures, halogens and strong oxidizers. Mercury can attack copper alloys. Mercury can react with many metals (i.e. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

Prohibitions on mixed storage : Mercury can attack copper alloys. Mercury can react with many metals (i.e. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

Storage area : Storage area should be made of fire-resistant materials.

Special rules on packaging : Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Mercury (7439-97-6)		
USA ACGIH	ACGIH TWA (mg/m³)	0.025 mg/m³
USA OSHA	OSHA PEL (Ceiling) (mg/m³)	0.1 mg/m³

8.2. Exposure controls

Appropriate engineering controls : Ensure adequate ventilation. Ensure exposure is below occupational exposure limits (where available). Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Personal protective equipment : Avoid all unnecessary exposure. Gloves. Protective clothing. Safety glasses. Mist formation: aerosol mask.

Hand protection : Wear neoprene gloves for routine industrial use. Use triple gloves for spill response, as stated in Section 6 of this SDS.

Eye protection : Splash goggles or safety glasses. For operation involving the use of more than 1 pound of Mercury, or if the operation may generate a spray of Mercury, the use of a faceshield is recommended.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : Maintain airborne contaminants concentration below provided exposure limits. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable state regulations. Use supplied air respiration protection if oxygen levels are below 19.5% or are unknown.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Colour : Silver white.

Odor	:	Odorless.
Odor threshold	:	Not applicable
pH	:	Not applicable
Relative evaporation rate (butylacetate=1)	:	No data available
Melting point	:	No data available
Freezing point	:	-38,87 °C (-37.97 F)
Boiling point	:	No data available
Flash point	:	Not applicable
Self ignition temperature	:	Not applicable
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	No data available
Vapour pressure	:	0,002 mm Hg at 25°C
Relative vapor density at 20 °C	:	6,9 (Air = 1)
Relative density	:	No data available
Relative density of saturated gas/air mixture	:	13,6
Solubility	:	No data available
Log Pow	:	No data available
Log Kow	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available
Explosive properties	:	No data available
Oxidizing properties	:	No data available
Explosive limits	:	Not applicable

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Stable. Reacts with (some) metals. Mercury can react with metals to form amalgams.

10.2. Chemical stability

Not established.

10.3. Possibility of hazardous reactions

Not established. Hazardous polymerization will not occur.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Acetylene and acetylene derivatives, amines, ammonia, 3-bromopropyne, boron diiodophosphide, methyl azide, sodium carbide, heated sulfuric acid, methylsilane/oxygen mixtures, nitric acid/alcohol mixtures, tetracarbonylnickel/oxygen mixtures, alkyne/silver perchlorate mixtures, halogens and strong oxidizers. Mercury can attack copper alloys. Mercury can react with many metals (i.e. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

10.6. Hazardous decomposition products

If this product is exposed to extremely high temperature in the presence of oxygen or air, toxic vapor of mercury and mercury oxides will be generated.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity	:	Fatal if inhaled.
Skin corrosion/irritation	:	Not classified pH: Not applicable
Serious eye damage/irritation	:	Not classified pH: Not applicable
Respiratory or skin sensitisation	:	Not classified
Germ cell mutagenicity	:	Not classified Based on available data, the classification criteria are not met
Carcinogenicity	:	Not classified

Mercury (7439-97-6)	
IARC group	3

Reproductive toxicity : May damage fertility or the unborn child.
Based on available data, the classification criteria are not met

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Causes damage to organs through prolonged or repeated exposure.
Based on available data, the classification criteria are not met
Causes damage to organs through prolonged or repeated exposure

Aspiration hazard : Not classified
Based on available data, the classification criteria are not met

Potential adverse human health effects and symptoms : Based on available data, the classification criteria are not met. Fatal if inhaled.

Symptoms/injuries after inhalation : Short-term over-exposures to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute,chemical pneumonia, and pulmonary edema (a potentially fatal accumulation of fluid in the lungs) . Depending on the concentration of over-exposure, cardiac abnormalities, damage to the kidney, liver or nerves and effects on the brain may occur. Long-term inhalation over-exposures can lead to the development of a wide variety of symptoms, including the following: excessive salivation, gingivitis, anorexia, chills, fever, cardiac abnormalities, anemia, digestive problems, abdominal pains, frequent urination, an inability to urinate, diarrhea, peripheral neuropathy (numbness, weakness, or burning sensations in the hands or feet), tremors (especially in the hands, fingers, eyelids, lips, cheeks, tongue, or legs), alteration of tendon reflexes, slurred speech, visual disturbances, and deafness. Allergic reactions (i.e. breathing difficulty) may also occur in sensitive individuals.

Symptoms/injuries after skin contact : Symptoms of skin exposure can include redness, dry skin, and pain. Prolonged contact may lead to ulceration of the skin. Allergic reactions (i.e. rashes, welts) may occur in sensitive individuals. Dermatitis (redness and inflammation of the skin) may occur after repeated skin exposures.

Symptoms/injuries after eye contact : Symptoms of eye exposure can include redness, pain, and watery eyes. A symptom of Mercury exposure is discoloration of the lens of the eyes.

Symptoms/injuries after ingestion : If Mercury is swallowed, symptoms of such over-exposure can include metallic taste in mouth, nausea, vomiting, central nervous system effects, and damage to the kidneys. Metallic mercury is not usually absorbed sufficiently from the gastrointestinal tract to induce an acute, toxic response. Damage to the tissues of the mouth, throat, esophagus, and other tissues of the digestive system may occur. Ingestion may be fatal, due to effects on gastrointestinal system and kidneys.

Chronic symptoms : Long-term over-exposure can lead to a wide range of adverse health effects. Anyone using Mercury must pay attention to personality changes, weight loss, skin or gum discolorations, stomach pains, and other signs of Mercury over-exposure. Gradually developing syndromes ("Erethism" and "Acrodynia") are indicative of potentially severe health problems. Mercury can cause the development of allergic reactions (i.e. dermatitis, rashes, breathing difficulty) upon prolonged or repeated exposures. Refer to Section 11 (Toxicology Information) for additional data.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - water : Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

Mercury (7439-97-6)	
LC50 fishes 1	0,5 mg/l (Exposure time: 96 h - Species: Cyprinus carpio)
EC50 Daphnia 1	5,0 µg/l (Exposure time: 96 h - Species: water flea)
LC50 fish 2	0,16 mg/l (Exposure time: 96 h - Species: Cyprinus carpio [semi-static])

12.2. Persistence and degradability

MERCURY (7439-97-6)	
Persistence and degradability	May cause long-term adverse effects in the environment.

12.3. Bioaccumulative potential

MERCURY (7439-97-6)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

MERCURY

Safety Data Sheet

according to the federal final rule of hazard communication revised on 2012 (HazCom 2012)

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Waste disposal must be in accordance with appropriate federal, state, and local regulations. This product, if unaltered by use, should be recycled. If altered by use, recycling may be possible. Consult Bethlehem Apparatus Company for information. If Mercury must be disposed of as hazardous waste, it must be handled at a permitted facility or as advised by your local hazardous waste regulatory authority.

Ecology - waste materials : Hazardous waste due to toxicity. Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

14.1. UN number

UN-No.(DOT) : 2809

DOT NA no. UN2809

14.2. UN proper shipping name

DOT Proper Shipping Name : Mercury

Department of Transportation (DOT) Hazard Classes : 8 - Class 8 - Corrosive material 49 CFR 173.136

Hazard labels (DOT) : 8 - Corrosive substances
6.1 - Toxic substances

DOT Symbols : A - Material is regulated as a hazardous material only when transported by air, W - Material is regulated as a hazardous material only when transported by water

Packing group (DOT) : III - Minor Danger

DOT Packaging Exceptions (49 CFR 173.xxx) : 164

DOT Packaging Non Bulk (49 CFR 173.xxx) : 164

DOT Packaging Bulk (49 CFR 173.xxx) : 240

14.3. Additional information

Other information : No supplementary information available.

Overland transport

No additional information available

Transport by sea

DOT Vessel Stowage Location : B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.

DOT Vessel Stowage Other : 40 - Stow "clear of living quarters",97 - Stow "away from" azides

Air transport

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 35 kg

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 35 kg

SECTION 15: Regulatory information

15.1. US Federal regulations

Mercury (7439-97-6)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 313 (Specific toxic chemical listings)	
EPA TSCA Regulatory Flag	S - S - indicates a substance that is identified in a proposed or final Significant New Uses Rule.
SARA Section 313 - Emission Reporting	1,0 %

15.2. International regulations

CANADA

MERCURY

Safety Data Sheet

according to the federal final rule of hazard communication revised on 2012 (HazCom 2012)

Mercury (7439-97-6)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision A - Very toxic material causing other toxic effects Class E - Corrosive Material

EU-Regulations

Mercury (7439-97-6)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances) substances.

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Mercury (7439-97-6)
Listed on the AICS (the Australian Inventory of Chemical Substances)
Listed on Inventory of Existing Chemical Substances (IECSC)
Listed on the Korean ECL (Existing Chemical List) inventory.
Listed on New Zealand - Inventory of Chemicals (NZIoC)
Listed on Inventory of Chemicals and Chemical Substances (PICCS)
Poisonous and Deleterious Substances Control Law
Pollutant Release and Transfer Register Law (PRTR Law)
Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

Mercury (7439-97-6)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
	Yes			

SECTION 16: Other information

Other information : None.

Full text of H-phrases: see section 16:

Acute Tox. 1 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 1
Acute Tox. 2 (Inhalation)	Acute toxicity (inhalation) Category 2
Aquatic Acute 1	Hazardous to the aquatic environment — AcuteHazard, Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment — Chronic Hazard, Category 1
Repr. 1B	Reproductive toxicity Category 1B
STOT RE 1	Specific target organ toxicity (repeated exposure) Category 1
H330	Fatal if inhaled
H360	May damage fertility or the unborn child
H372	Causes damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

NFPA health hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.

C.2. Nickel

SAFETY DATA SHEET

Creation Date 26-Sep-2009 **Revision Date** 05-Jan-2016 **Revision Number** 3

1. Identification

Product Name **Nickel, reference standard solution 1000 ppm**

Cat No. : **SN70-100; SN70-500**

Synonyms None.

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Respiratory Sensitization	Category 1
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation
May cause cancer by inhalation
May damage the unborn child

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
In case of inadequate ventilation wear respiratory protection
Use only outdoors or in a well-ventilated area
Keep only in original container
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Water	7732-18-5	97.5
Nitric acid	7697-37-2	2.0
Nickel(II) nitrate, hexahydrate (1:2:6)	13478-00-7	0.5

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Move to fresh air. Get medical attention if symptoms occur. If not breathing, give artificial respiration.

Ingestion Clean mouth with water and drink afterwards plenty of water.

Most important symptoms/effects None reasonably foreseeable.
Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point Not applicable
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Nitrogen oxides (NOx) Nitrous vapors Nickel oxides.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions Should not be released into the environment. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.

Storage Corrosives area. Do not store in metal containers. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric acid	TWA: 2 ppm STEL: 4 ppm	(Vacated) TWA: 2 ppm (Vacated) TWA: 5 mg/m³ (Vacated) STEL: 4 ppm (Vacated) STEL: 10 mg/m³ TWA: 2 ppm TWA: 5 mg/m³	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m³ STEL: 4 ppm STEL: 10 mg/m³
Nickel(II) nitrate, hexahydrate (1:2:6)	TWA: 0.1 mg/m³	(Vacated) TWA: 0.1 mg/m³	IDLH: 10 mg/m³ TWA: 0.015 mg/m³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Nitric acid	TWA: 2 ppm TWA: 5.2 mg/m³ STEL: 4 ppm STEL: 10 mg/m³	TWA: 2 ppm TWA: 5 mg/m³ STEL: 4 ppm STEL: 10 mg/m³	TWA: 2 ppm STEL: 4 ppm
Nickel(II) nitrate, hexahydrate (1:2:6)	TWA: 0.1 mg/m³	TWA: 0.1 mg/m³ STEL: 0.3 mg/m³	TWA: 0.1 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Blue green
Odor	Odorless
Odor Threshold	No information available
pH	< 2.0 Acidic
Melting Point/Range	No data available
Boiling Point/Range	> 100 °C / 212 °F
Flash Point	Not applicable
Evaporation Rate	> 1 (ether = 1)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	14 mmHg @ 20 °C
Vapor Density	0.7
Specific Gravity	> 1.0
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available

Viscosity No information available

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Excess heat. Incompatible products.

Incompatible Materials Strong bases, Strong reducing agents

Hazardous Decomposition Products Nitrogen oxides (NOx), Nitrous vapors, Nickel oxides

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information No acute toxicity information is available for this product
Oral LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Dermal LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Vapor LC50 Category 3. ATE = 2 - 10 mg/l.
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	-	Not listed	Not listed
Nitric acid	Not listed	Not listed	LC50 = 2500 ppm. (Rat) 1h
Nickel(II) nitrate, hexahydrate (1:2:6)	LD50 = 1620 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Severe eye irritant Irritating to respiratory system and skin

Sensitization No information available

Carcinogenicity Contains a known or suspected carcinogen. The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Nitric acid	7697-37-2	Not listed	Not listed	Not listed	Not listed	Not listed
Nickel(II) nitrate, hexahydrate (1:2:6)	13478-00-7	Group 1	Known	Not listed	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available
Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment. May cause long-term adverse effects in the environment. Do not allow material to contaminate ground water system.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Nitric acid	Not listed	LC50: = 72 mg/L, 96h (Gambusia affinis)	Not listed	Not listed

Persistence and Degradability May persist
Bioaccumulation/ Accumulation No information available.

Mobility -

Component	log Pow
Nitric acid	-2.3

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
UN-No UN3264
Proper Shipping Name CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Proper technical name Nitric acid
Hazard Class 8
Packing Group III

TDG
UN-No UN3264
Proper Shipping Name CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class 8
Packing Group III

IATA
UN-No UN3264
Proper Shipping Name CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class 8
Packing Group III

IMDG/IMO
UN-No UN3264
Proper Shipping Name CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class 8
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	X
Nitric acid	X	X	-	231-714-2	-		X	X	X	X	X
Nickel(II) nitrate, hexahydrate (1:2:6)	-	-	-	-	-		X	-	X	X	-

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Nitric acid	7697-37-2	2.0	1.0
Nickel(II) nitrate, hexahydrate (1:2:6)	13478-00-7	0.5	0.1 1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nitric acid	X	1000 lb	-	-
Nickel(II) nitrate, hexahydrate (1:2:6)	-	-	X	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Nickel(II) nitrate, hexahydrate (1:2:6)	X		-

OSHA Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Nitric acid	-	TQ: 500 lb

CERCLA

Component	Hazardous Substances RQs	CERCLA EHS RQs
Nitric acid	1000 lb	1000 lb

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Nickel(II) nitrate, hexahydrate (1:2:6)	13478-00-7	Carcinogen	-	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Water	-	-	X	-	-
Nitric acid	X	X	X	X	X
Nickel(II) nitrate, hexahydrate (1:2:6)	-	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Nitric acid	2000 lb STQ

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
E Corrosive material
D1B Toxic materials
D2A Very toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

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Print Date 05-Jan-2016
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

C.3. Dimethylglyoxime

Material Safety Data Sheet
Dimethylglyoxime MSDS

Section 1: Chemical Product and Company Identification

Product Name: Dimethylglyoxime

Catalog Codes: SLD1648

CAS#: 95-45-4

RTECS: EK2975000

TSCA: TSCA 8(b) inventory: Dimethylglyoxime

CI#: Not available.

Synonym: 2,3-Butanedionedioxime; Biacetyl dioxime; Diacetyldioxime; 2,3-Diisonitrosobutane

Chemical Name: 2,3-Butanedione Dioxime

Chemical Formula: C4H8N2O2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Dimethylglyoxime	95-45-4	100

Toxicological Data on Ingredients: Dimethylglyoxime LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2), nitrogen oxides (NO, NO2...).

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:
Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: As with most organic solids, fire is possible at elevated temperatures

Special Remarks on Explosion Hazards:
Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, reducing agents, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 116.12 g/mole

Color: White. Off-white.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: 239°C (462.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: 0% (v/v).

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Soluble in methanol, diethyl ether, acetone. Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Rat] - Route: Oral; Dose: 250 mg/kg

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. Eyes: May cause eye irritation. Inhalation: May cause respiratory tract and mucous membrane irritation. Ingestion: May be harmful if swallowed. May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Dimethylglyoxime

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
R22- Harmful if swallowed. S24/25- Avoid contact with skin and eyes. S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 11:50 AM

Last Updated: 05/21/2013 12:00 PM

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C.4. Nitric acid

SAFETY DATA SHEET

Creation Date 12-Mar-2009 **Revision Date** 15-Dec-2015 **Revision Number** 4

1. Identification

Product Name **Nitric acid (65 - 70%)**

Cat No. : **A198C-212, A200-212, A200-212LC, A200-500, A200-500LC, A200-612GAL, A200C-212, A200S-212, A200S-212LC, A200S-500, A200SI-212, A467-1, A467-2, A467-250, A467-500, A483-212; S719721**

Synonyms Azotic acid; Engraver's acid; Aqua fortis

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Oxidizing liquids	Category 2
Corrosive to metals	Category 1
Skin Corrosion/irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May cause fire or explosion; strong oxidizer
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation

Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep/Store away from clothing/ other combustible materials
Take any precaution to avoid mixing with combustibles
Keep only in original container
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

Unknown Acute Toxicity
.? percent of the mixture consists of ingredient(s) of unknown acute toxicity

3. Composition / information on ingredients

Component	CAS-No	Weight %
Nitric acid	7697-37-2	65 - 70
Water	7732-18-5	30 - 35

4. First-aid measures

General Advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

	Immediate medical attention is required.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before re-use. Call a physician immediately.
Inhalation	If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Remove from exposure, lie down. Call a physician immediately.
Ingestion	Do not induce vomiting. Never give anything by mouth to an unconscious person. Clean mouth with water. Call a physician immediately.
Most important symptoms/effects	Causes burns by all exposure routes. . Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	CO_2, dry chemical, dry sand, alcohol-resistant foam.
Unsuitable Extinguishing Media	No information available
Flash Point	Not applicable
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Oxidizing Properties	Oxidizer
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes. Oxidizer: Contact with combustible/organic material may cause fire. May ignite combustibles (wood paper, oil, clothing, etc.).

Hazardous Combustion Products
Nitrogen oxides (NOx) Thermal decomposition can lead to release of irritating gases and vapors
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
4	0	0	OX

6. Accidental release measures

Personal Precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Use personal protective equipment.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Sweep up and shovel into suitable containers for disposal.

7. Handling and storage

Handling Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Do not breathe vapors or spray mist. Keep away from clothing and other combustible materials.

Storage Keep containers tightly closed in a cool, well-ventilated place. Do not store near combustible materials.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric acid	TWA: 2 ppm STEL: 4 ppm	(Vacated) TWA: 2 ppm (Vacated) TWA: 5 mg/m³ (Vacated) STEL: 4 ppm (Vacated) STEL: 10 mg/m³ TWA: 2 ppm TWA: 5 mg/m³	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m³ STEL: 4 ppm STEL: 10 mg/m³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Nitric acid	TWA: 2 ppm TWA: 5.2 mg/m³ STEL: 4 ppm STEL: 10 mg/m³	TWA: 2 ppm TWA: 5 mg/m³ STEL: 4 ppm STEL: 10 mg/m³	TWA: 2 ppm STEL: 4 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Keep away from food, drink and animal feeding stuffs. When using, do not eat, drink or smoke. Contaminated work clothing should not be allowed out of the workplace. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing. For environmental protection remove and wash all contaminated protective equipment before re-use. Wear suitable gloves and eye/face protection.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear Colorless, Light yellow
Odor	Strong Acrid
Odor Threshold	No information available
pH	< 1.0 (0.1M)

Melting Point/Range	-41 °C / -41.8 °F
Boiling Point/Range	Not applicable °C / °F
Flash Point	Not applicable
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	0.94 kPa (20°C)
Vapor Density	No information available
Specific Gravity	1.40
Solubility	miscible
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	HNO3
Molecular Weight	63.02

10. Stability and reactivity

Reactive Hazard Yes

Stability Oxidizer: Contact with combustible/organic material may cause fire.

Conditions to Avoid Incompatible products. Combustible material. Excess heat. Exposure to air or moisture over prolonged periods.

Incompatible Materials Combustible material, Strong bases, Reducing agents, Metals, Powdered metals, Organic materials, Aldehydes, Alcohols, Cyanides, Ammonia, Strong reducing agents

Hazardous Decomposition Products Nitrogen oxides (NOx), Thermal decomposition can lead to release of irritating gases and vapors

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC50 Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Nitric acid	Not listed	Not listed	LC50 = 2500 ppm. (Rat) 1h
Water	-	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes severe burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico

Nitric acid	7697-37-2	Not listed	Not listed	Not listed	Not listed	Not listed
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms. Contains a substance which is:. Harmful to aquatic organisms. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Nitric acid	Not listed	LC50: = 72 mg/L, 96h (Gambusia affinis)	Not listed	Not listed

Persistence and Degradability Miscible with water Persistence is unlikely based on information available.
Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Nitric acid	-2.3

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
- **UN-No** UN2031
- **Proper Shipping Name** NITRIC ACID
- **Hazard Class** 8
- **Subsidiary Hazard Class** 5.1
- **Packing Group** II

TDG
- **UN-No** UN2031
- **Proper Shipping Name** NITRIC ACID
- **Hazard Class** 8
- **Subsidiary Hazard Class** 5.1
- **Packing Group** II

IATA
- **UN-No** UN2031

Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IMDG/IMO

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Nitric acid	X	X	-	231-714-2	-		X	X	X	X	X
Water	X	X	-	231-791-2	-		X	-	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Nitric acid	7697-37-2	65 - 70	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	Yes

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nitric acid	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration

Nitric acid (65 - 70%) **Revision Date** 15-Dec-2015

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Nitric acid	-	TQ: 500 lb

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Nitric acid	1000 lb	1000 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitric acid	X	X	X	X	X
Water	-	-	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Nitric acid	2000 lb STQ

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
C Oxidizing materials
E Corrosive material
D2B Toxic materials

16. Other information

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Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the